Appendix A - DAPSII/DAMS Interface

The present DAPS has two or three unique DAPS/DAMS interfaces. The DAPS has a 10 channel 100 bps synchronous interface, a 10 channel 300 bps synchronous interface, and a 1200 bps asynchronous interface.

The present DAPS supports 27 synchronous DAMS inputs and 20 asynchronous inputs. We presently have 17 operational and two test DAMS ten channel chassis with 100 bps demodulators. The High Data Rate (HDR) project is delivering two 300 bps ten channel chassis and two 1200 bps five channel chassis. The DAPSII shall have 35 asynchronous DAMS inputs. The DAPSII asynchronous DAMS interface shall account for the time lag and/or time delay(s) in HDR demodulator data handling/processing due to Trellis coding and data interleaving. These processes cause up to a five second delay for this data after receipt of the frame sync signal. The DAPSII shall be determine the appropriate delay (Trellis coded only, Trellis coded with short, Trellis coded with long) for time tagging the signal in the system.

The existing synchronous DAPS/DAMS interfaces (See appendix A.1) are to be converted to asynchronous for ingest into the DAPSII. While the converted DAMS/DAPSII interface is not required to support multiple data rates (i.e. 100, 300, and 1200 bps), it shall operate transparently with the respective 100 bps chassis. If the synchronous to asynchronous converters are provided as custom developed hardware then all of the requirements of NESDIS standard S24.802 shall apply. If a COTS or hy-bird converter solution is offered then the offer must demonstrate how the hardware/firmware solution to fulfills the requirement. The existing DAPS/DAMS 1200 bps interface will no longer be supported in the DAPSII.

The new DAPSII/DAMS interface shall be asynchronous using packets based on a modified Kermit file transfer protocol. Each packet shall have a defined start byte, an ending byte, a checksum, and may contain a variable number of data bytes. Each DCP message is transferred to the DAPS in a series of packets: a "start'" packet, one to many "data" packets, and an "end" packet. The interface shall be the same for 100 bps, 300 bps or 1200 bps in a 10 to a chassis configuration.

DAPSII/DAMS Multiplexer Interface

The DAMS multiplexer inputs DCP message data from up to ten demodulators and converts it into a series of data packets which are sent to the local receive site computer system (DAPS). The DAMS multiplexer communicates with the receive site computer via a Universal Synchronous / Asynchronous Receiver/Transmitter (UART) configured to operate at 9600 or 19200 bps 8 data bits, no parity, and 1 stop bit. The data packets to the receive site computer are provided at three independently buffered RS-232 ports on the rear of the chassis. This allows connection of the output data to two or three independent redundant computer systems.

Multiplexer Data Packets

The basic structure of the data packets passed from the DAMS multiplexer to the receive site computer is shown on the next page. Every packet contains the slot number for that particular packet. This is necessary since up to 10 different messages may be received at the same time (one - on every demodulator installed). The slot number allows DAPSII to properly sort the data from the Multiplexer.

Multiplexer Data Packet Structure

Byte(s) Transmitted	Explanation
<SOH>	1 byte, ASCII Start of Header, 01 Hex
<Packet sequence Number>	1 byte, make printable as follows: number = 0 to 94 decimal, transmit = number + 20 Hex.
<Slot Number>	1 byte, Demod Slot number ASCII '0' to '9', 30 Hex to 39 Hex.
<Packet Type>	1 byte, ASCII character as follows: 'R' -- Reset packet, transmitted when Mux is reset. 'S' -- Start of message packet 'D' -- Data packet(s) 'E' -- End of message packet 'T' -- Test (Diagnostic) packet
<Number of bytes to follow>	1 byte, make printable, as follows: number = 0 to 94 decimal, transmit = number + 20 Hex (The number of bytes in a packet is actually limited to 60 to insure that any waiting "start" packets are transferred quickly.)
<Data> <Last Data>	0 to 60 bytes, 8-bit data, ASCII or binary
<EXT>	1 byte, ASCII' End of Text character03 Hex
<Checksum>	1 byte, Kermit checksum, as follows: All bytes between <SOH> and <ETX> are included (not including <SOH> or<ETX>). x = arithmetic sun of bytes. check = 20H + ((x + ((x & C0)/40H)) & 3F). where & is bitwise AND (This involves bits 6: and 7 in a printable character.)

Packet Types

There are five types of data packets passed from the DAMS multiplexer to the receive site computer.

The "Start" pacet (packet type 'S') is sent when a demodulator acquired carrier, bit sync, frame *sync*, and received the address of the platform that is sending the message. This can be used by the receive site computer to consistently

time stamp the message, and to determine whether that platform address is of interest to the user. The data field of the "Start" packet contains the platform's four byte address. It could also contain other information about the message to follow, such as the MLS word or whether it was to be 8-bit binary or 7-bit ASCII data.

Start packets have priority over all other packets waiting to be sent from the Multiplexer to DAPSII. This insures that accurate time tags are given to all received messages.

The "Data" packets (packet type 'D') contain the message data for the message being received by a particular demodulator. A single massage may contain one or many data packets, depending on the number of bytes in the message.

The "End" packet (packet type 'E') signals the receive site computer that the current message for that slot is complete. The data field of the "End" packet also contains the four quality measurements for the message just received. The quality measurements include the signal strength, frequency offset from channel center, modulation angle, and data quality.

A normal message sequence consists of a "Start" packet containing the address of the platform, one or more "Data" packets with the message data, and one "End" packet with the quality measurements. These packets are transferred to DAPS as the data is received; there could be up to approximately 5 seconds between data packets (at 100 bps). Some messages may last up to two minutes.

The "Reset" packet (packet type 'R') is sent any time the Multiplexer is reset, normally only at power-up or when the multiplexer card is removed and re-inserted. When the receive site computer receives a "Reset" packet, it must reset its packet sequence counter and status for the ten demodulators. For instance, if the receive site computer was in the middle of a message for a particular slot, it might be expecting to receive a "Data" or "End" packet. If it gets a "Reset" packet it must abandon or terminate that message and reset the status for all the demodulator slots.

The "Test" packet (packet type 'T'), or diagnostic packet, is sent at least once every 60 seconds. It consists of a one byte status for each slot for ten bytes in the data field. The byte is an ASCII '0' if the demodulator is not installed or is not responding to the Multiplexer BUS checks. The byte is an ASCII '1' if the demodulator is present and is responding to BUS checks. The byte my hold other values to indicate some other type of demodulator error status.

Other Requirements

a. Accurate time tagging of messages

Each message begins with a start packet. The Multiplexer maintains two packet queues for data transfer to the DAPS: one for message data and one for "start" packets. If any "start" packets are waiting to be sent, they are sent before any waiting "data" or "end" packets. Data packets are limited to 60 bytes which yields a maximum data packet duration of 70mS. This insures that any "start " packet. are sent to the DAPS as quickly as possible. The DAPSII shall time tag the messages at the time the "start" packet is received. The

ID is contained in the data field of the "start" packet. The data field may also contain information about the message to follow: ASCII / Binary, MLS, etc.

b. Transfer DCP message data from demodulators to DAPSII.

The DCP message portion of the data is transferred in "data" packets**.** This is clearly delineated from the ID and quality measurements.

c. Transfer quality measurements for each DCP message to DAPSII.

Quality measurements will be transferred to the DAPS in the "end" packets. Each "end" packet contains the four quality measurements in the standard six byte format. This packet also informs the DAPS that the message on this demodulator is over.

d. Transfer demodulator error/status information to DAPS.

Demodulator error and status information is transferred to the DAPS in a "test" packet at least once per minute. This packet contains status information for up to ten installed demodulators. The packet contains 10 bytes in the data field: one for each of the 10 slots in the chassis. The byte is an ASCII '0' if there is no demodulator installed or if the demodulator is not responding to bus checks. The byte is an ASCII '1' if the demodulator is installed and operating normally. The byte could hold other values to indicate more specific error modes.

Advantages of the New Asynchronous DAMS Interface

a. Enables mixing of 100, 300 and 1200 bps demodulators within a single chassis.

b. One interface to develop and debug. It handle the 100, 300 and 1200 bps systems.

c. The asynchronous interface (either end) is easily simulated with common laptop or desktop PC.

The interface between the DAMS multiplexer and each demodulator will be the same for 100, 300 and 1200 bps demods. The interface between the DAMS multiplexer and the DAPSII is the same no matter what kind of demodulator is installed.

d. The data can be more efficiently transferred using the defined data packets. The following pages contain several examples of efficiency based on the packet approach.

LIST OF ACRONYMS

ASCII	American Standard Code for Information Interchange
BER	Bit Error Rate
bps	bit per second
DAPS	Data Collection System Automatic Processing System
DCE	Data Communication Equipment
DCP	Data Collection Platform
DCS	Data Collection System
DTE	Data Terminal Equipment
GOES	Geostationary Operational Environmental Satellite
Hz	Hertz
ICD	Interface Control Document
NESDIS	National Environmental Satellite, Data, and Information System

1. INTRODUCTION

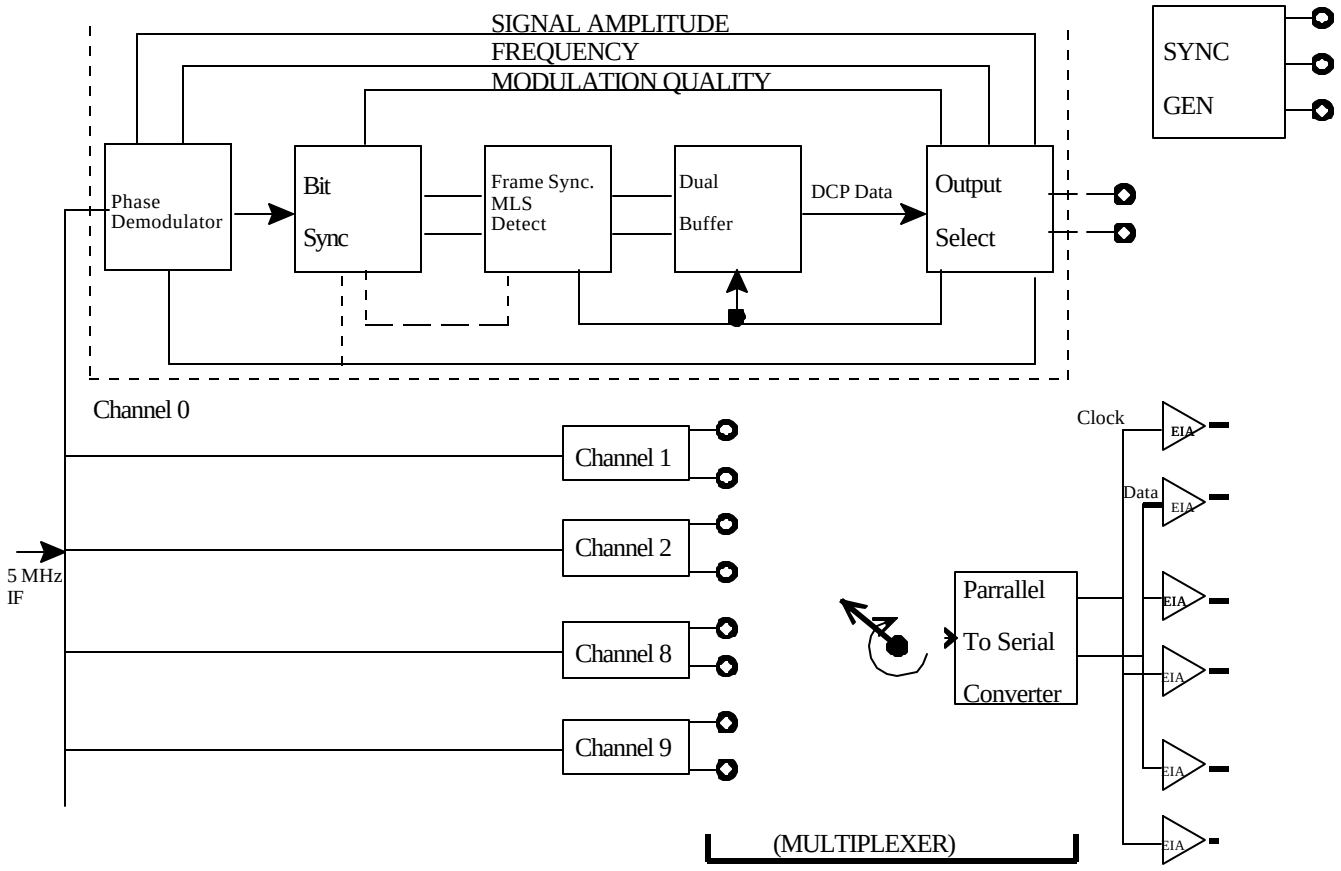
1.1. Background

The National Environmental Satellite, Data, and Information Service (NESDIS) manages and operates the U. S. Geostationary Operational Environmental Satellite (GOES) system. One mission of the GOES system is to support the Data Collection System (DCS). The DCS gathers point source environmental data from Data Collection Platforms (DCP) via GOES link. The DCP data is processed in the Data Collection System Automatic Processing System (DAPS) at Wallops Station, Virginia and distributed to system users.

1.2. DAPS 100/300 bps Synchronous DAMS Interface

As an aid in detailing this interface a more complete (not functional) description of the DAMS equipment is provided in Figure A-1. The frequency-corrected 5 MHz IF is applied to the ten demodulator chassis in parallel. Each demodulator searches for a DCP signal and attempts to phase-lock to its carrier. Once locked, the data and clock are recovered by a 100-Hz bit synchronizer. For the 300 bps DAMS a symbol synchronizer is used in lieu of the bit synchronizer. After bit/symbol sync the data is scanned for a 15-bit multi-level sequence (MLS) frame synchronization pattern which identifies the beginning of a DCP message. Once detected, the data is accumulated in 8-bit bytes for eventual transfer to the computers via an 8-bit parallel-to-serial converter. Transfer of all ten channels in a group is made possible by stepping the parallel to serial converter from channel to channel. Each channel must be scanned at slightly more than the DCP character rate (12.5 ms for 100 bps or 6.67ms for 300 bps) to prevent an overflow condition in the dual buffer. Since DCP's on different channels may have minutely different data rates ($\pm$0.01%), the fixed rate sampling described above can result in an underflow condition - a condition where only seven bits have been accumulated since the last scan. In this situation, no data is transferred and a flag accompanying the data so indicates.

Figure 1-1 - 100/300 bps DAMS FUNCTIONAL BLOCK DIAGRAM



2. SCOPE

This ICD defines the design and performance requirements for the 100/300 bps DAMS/DAPS interface. Section 3 lists the applicable documents as required. Sections 4, 5, and 6 establish the electrical, mechanical, and data definition specification requirements respectively.

3. APPLICABLE DOCUMENTS

The following document(s) form a part of this specification. In the event of a conflict between the referenced document and this specification, the content of this specification shall take precedence.

3.1. Government Documents

None.

3.2 Non-Government Documents

Standards	Interface Between Data Terminal Equipment EIA RS-232C(DTE) and Data Communication Equipment (DCE) June, 1981 Employing Serial Binary Data Interchange

4. ELECTRICAL SPECIFICATION REQUIREMENTS

4.1. General

The 100/300 bps DAMS/DAPS interface consists of two identical EIA Standard RS-232C synchronous interfaces. The 100/300 bps DAMS provides an additional RS-232C synchronous interface to be used for monitor purposes only. Electrical characteristics of the three (3) interfaces such as voltage levels, input and output impedances, and driver slew rate shall meet the EIA Standard RS- 232C requirements. The RS-232C signal lines are defined in paragraph 4.6.

4.2. Bit Rate

Each RS-232C interface operates at 2400 bps for 100 bps and at 9600 bps for 300 bps .

4.3 Character Length

The character length for each RS-232C interface shall be eight bits.

4.4 Signal Lines

4.4.1. Definition

The 100/300 bps DAMS is defined as the data communication equipment (DCE) per the EIA RS-232C standard. The DAPS is defined as the data terminal equipment (DTE). Each RS-232C interface at the DAMS connector shall contain the following signal lines (Figure 4-1):

PIN	Description	RS-232C Circuit
1	Protective Ground	AA
7	Signal Ground	AB
3	Received Data (to DAPS)	BB
6	DAMS Powered Up (DSR)	CC
17	Receive Timing	DD

4.4.2. Functional Description

The functional description of each signal line is listed in Table 4-1.

TABLE 4-1: RS-232C SIGNAL LINE DESCRIPTION

SIGNAL	SOURCE	FUNCTION
Protective Ground	-----	Chassis Ground
Signal Ground	-----	Ground reference point relative to all other RS-232 signals (except protective ground)
Received Data	100/300 DAMS	Sensor and status data to the DAPS.
Receive Timing	100/300 DAMS	Clock associated with received data (to DAPS).
Data Set Ready	100/300 DAMS	Indicates status condition of (DSR) the 300 bps DAMS. DSR will go (Powered Up)to 'ON' when unit is powered up.

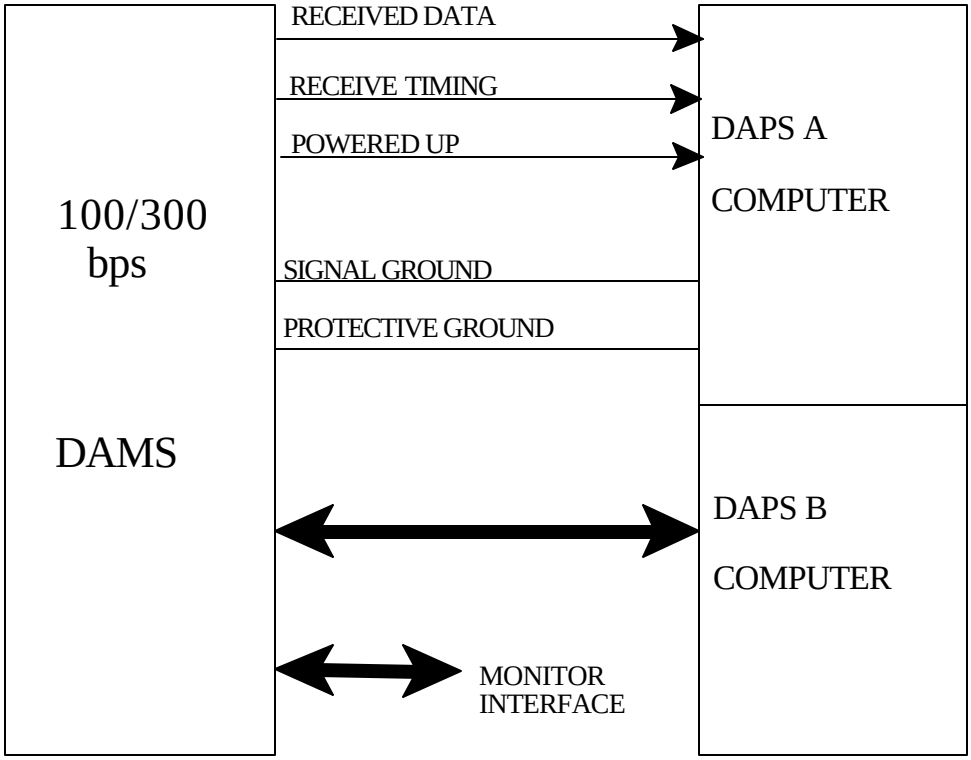


Figure 4-1 - 100/300 bps DAMS/DAPS INTERFACE

5. MECHANICAL SPECIFICATION REQUIREMENTS

5.1. Connectors

The panel connector on the 300 bps DAMS for each of the three RS- 232C interfaces shall be a DB-25-S (female) type connector. The panel connector on the DAPS for each of the two RS-232C interfaces shall be a DB-25-P (male) type connector.

5.2. Pin Designation

The pinout for the RS-232C interfaces shall be as defined in Table 5-1.

5.3. Cable

A separate cable shall be provided for each RS-232C interface. The type and length of the cables shall be customer specified.

TABLE 5-1: PIN DESIGNATION

SIGNAL	DEMOD CONNECTOR PIN NO.	DAPS CONNECTOR PIN NO.
Protective Ground	1	1
Signal Ground	7	7
Received Data	3	3
Receive Timing	17	17
Data Set Ready	6	6

6. DATA DEFINITION

6.1. Data Block

Figure 6-1 shows the 100 bps or 300 bps DAMS to DAPS data block format. The data blocks shall be repeated continuously over the interface to the host computer. The data block shall contain four bytes of sync followed by 10 words (16 bits per word) of channel data. The sync character shall be defined as binary 01101000 (LSB) which is an ASCII "SYN" character. Each channel word shall consist of 8 bits of flag data followed by 8 bits of channel data.

6.2. Flag Byte Definition

The flag byte data contains control and error information. The flag bits shall be defined as described in Figure 6-2. The first bit transferred to the host shall be flag bit 1 (LSB).

Flag bit 8 shall define the validity of the data. Valid data is defined as, 1) acquisition of signal by the demodulator, 2) the MLS is detected, and 3) input dual buffer of the demodulator is not in an underflow condition. Flag bit 7 shall identify the end of a message and is true for only one byte of data (last DAMS quality measurement character that is appended to the end of the message). Flag bit 6 shall be the calculation of parity of the data byte. If true, a parity error in the respective data byte has occurred (odd parity). Flag bit 5 shall indicate MLS detect. Flag bit 4 shall define the demodulator lock status. Flag bit 3 shall be used to indicate a failure in the demodulator. Flag bit 2 is not assigned. Finally, flag bit 1 (LSB)

shall indicate the status of the quality measurement process. This bit shall be true for all six characters including the space character preceding the quality measurements. Note that flag bit 1 shall be false when the QMs are disabled for the entire message.

FIGURE 6-1: DEMOD TO DAPS DATA BLOCK FORMAT

SYNC (4)	CH 0	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6	CH 7	CH 8	CH 9	SYNC (4)

D8	D7	D6	D5	D4	D3	D2	D1	F8	F7	F6	F5	F4	F3	F2	F1

FIGURE 6-2: FLAG BYTE DEFINITION

FLAG	VALUE	DEFINITION
F1	1	Output of QM (quality meas.) in progress
	0	QM output not in progress
F2	X	Not assigned
F3	1	Failed demodulator
	0	Failure not detected
F4	1	Channel lock
	0	Channel not in lock
FLAG	VALUE	DEFINITION

F5	1	MLS detected
	0	MLS not detected
F6	1	Parity error
	0	No parity error
F7	1	Logical 'AND' of flag bit 8 and end of message. Valid for one data byte.
	0	All bytes except one at end of message byte.
F8	1	Valid data.
	0	Data to be ignored.

6.3. Data Byte Definition

The data byte contains the DCP address, the sensor data, and the quality measurement data. The flag and data byte format and sequence of events for a message transfer shall be as defined in Table 6-1. The first data byte (as determined by the 8th flag bit going true) shall contain bits 7 to 14 of the second received MLS sync sequence. The second byte shall contain the 15th bit of the second MLS followed by the first seven bits of the DCP address. The 3rd, 4th, and 5th bytes shall contain the remaining 24 bits of the DCP address. The next group of data bytes shall contain the DCP sensor data. The sensor data shall be represented as 7-bit ASCII. All DCP sensor data shall be transmitted to the host in the same order as received. As shown in the message transfer format, the end of message designation to the host shall be either an ASCII space character (EOT) in the data byte for ASCII or the 31 bit international DCP EOT for binary (see HDR specifications). Immediately following the EOT character, the demodulator shall transfer quality measurement data to the host.

6.4. Quality Measurement Data

Each message shall contain information data on the following signal quality measurements performed by the 100/300 bps DAMS:

Received signal strength: Represented by two ASCII-coded characters with range 32_{10} to 57_{10} in dB_m units (reference 0 - implied EIRP, assuming the pilot is a +47 dBm reference).

Frequency error: Represented by two ASCII-coded characters. The first character is either plus (+) or minus (-) indicating the DCP transmit frequency is above or below the channel center frequency respectively. The second character has the range 0-9 and the letter 'A'. The number 0-9 represents the frequency difference from the channel center in increments of 50 Hz. The letter 'A' represents the worst case frequency error that the demodulator can acquire.

Modulation index (deviation): Represented by one ASCII- coded character. The character has three values that indicate the measured phase shift. The ASCII character 'N' indicates normal phase shift $\pm 5^o$ within assigned phase state, character 'L' indicates a phase average over time less than the assigned state value minus 5^o, and the character 'H' indicates a phase average over time greater than the assigned value plus 5^o.

Data quality: Represented by one ASCII-coded character. The character has three values that indicate the measured channel bit-error-rate (BER). The ASCII character 'N' indicates a BER of 10^{-6} or better, character 'F' a BER between 10^{-4} and 10^{-6}, and the character 'P' a BER of 10^{-4} or worse.

The quality measurement data (6 words) shall be 7-bit ASCII regardless of the sensor data type (odd parity).

If the 100/300 bps DAMS has a quality measurement disable function, when activated, the demodulator shall transmit a slash ASCII character ('/') in place of the six quality measurement characters as described above. Flag bit F1 shall be zero for the six words containing the slash

TABLE 6-1: MESSAGE DATA TRANSFER SEQUENCE

MESSAGE EVENT	FLAG BYTE F8	F7	F6	F5	F4	F3	F2	F1	DATA BYTE D8	D7	D6	D5	D4	D3	D2	D1	DATA DEFINITION
Idle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	CHANNEL NOISE
DEMOD Lock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	None
Bit Sync Lock	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	None
MLS Detect	1	0	P	1	1	0	0	0	1	1	0	1	0	1	1	0	Bits 14-7 of MLS
1st -7 bits Address	1	0	P	1	1	0	0	0	A	A	A	A	A	A	A	1	Bits 7 - 1 of Address & MLS Bit 15 of MLS
Next 8 bits - Address	1	0	P	1	1	0	0	0	A	A	A	A	A	A	A	A	Bits 15 - 8 of Address
Next 8 bits - Address	1	0	P	1	1	0	0	0	A	A	A	A	A	A	A	A	Bits 23 - 16 of Address
Next 8 bits - Address	1	0	P	1	1	0	0	0	A	A	A	A	A	A	A	A	Bits 31 - 24 of Address
DCP Data	1	0	P	1	1	0	0	0	D	D	D	D	D	D	D	D	ASCII Characters
.																	
.																	
1st EOT Received	1	0	0	X	X	0	0	0	0	0	1	0	0	0	0	0	ASCII Space Character
Next 8 bits	1	0	0	0	0	0	0	1	M	M	M	M	M	M	M	M	1st DAMS Measurement
Next 8 bits	1	0	0	0	0	0	0	1	M	M	M	M	M	M	M	M	2ond DAMS Measurement

Next 8 bits	1	0	0	0	0	0	0	1		M	M	M	M	M	M	M M Last D A M S M e asur eme nt

character.

Following the six words of quality measurement data, the 100/300 bps DAMS transmits one additional word with flag bits 7 and 8 set to 'one' to indicate end of the entire message.

7. INSTALLATION AND REMOVAL OF DEMODULATOR UNITS

As previously described, each 100/300 bps DAMS unit shall operate with 0 to 10 channels installed. Each channel shall be immune to transients while one or more channels are installed or removed. The process of removing a channel shall not begin a false message to the host computer. The installation of a channel shall not disrupt ongoing processes and cause loss of valid messages.